formance of work, as illustrated in the observations just described, is a manifestation, is a complex symptom. In how far it is dependent in a given case, on a neuropathic state and in how far on weakness of skeletal musculature, it is often impossible to determine. It seems clear, however, that in cases of "effort syndrome" in which the symptoms have been present for many years, as they had been in most of the patients at Lakewood, both factors are to be considered. It is probable that a vicious circle is easily established and that each factor reacts detrimentally on the other.

CONCLUSIONS. A study was undertaken of the changes in pulse-rate and blood-pressure taking place in fifty patients with "effort syndrome" after the hardest exercise which they could be induced to perform. These were for the most part patients with symptoms of many years' duration. The amount of work which they could do before becoming fatigued was much less than was done by normal controls. The pulse-rate at rest was higher than in the normals, but the rise after exercise and the time for return of the pulse-rate to its resting value were not definitely abnormal. No "delayed rise" of blood-pressure suggesting myocardial inefficiency was observed. The amount of work which the subjects were able to perform usually corresponded closely to their physical strength as determined by tests of the skeletal muscles, and this indicates that lack of development of the skeletal muscular system is a factor to be considered in the cause of the fatigue following slight exertion in certain types of cases of "effort syndrome."

THE POSITION OF THE ARM IN BLOOD-PRESSURE MEASUREMENTS.

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BLOOD-PRESSURE readings should be obtained with the patient's arm at the side of his chest, as the normal reading varies considerably with the arm in different positions. This holds for the seated, the standing and the recumbent postures.

Changing the position of the arm, as in elevating the elbow, produces changes in the blood-pressure of the arm probably as the result of both vasomotor and hydrostatic effects upon the column of blood. Leonard Hill has shown there exists a difference between the pressures in two arteries placed at different levels in relation to the heart. Thus the two arms in different positions and the arm and leg readings would differ by the hydrostatic pressure of the column of blood which separates the points of measurement.

The following studies were made upon men between the ages of twenty and thirty years, with a view to determine the effect upon the blood-pressure readings of raising the arm to various angles from the side of the body. The following groups of cases were examined:

Normal heart	27 cases
Neurocirculatory asthenia	13 "
Thyrotoxic and exophthalmic goitre	7 "
Simple tachycardia	5 "
Paroxysmal tachycardia	5 "
Nephritic hypertension	5 "
Mitral regurgitation	2 "
Aortic regurgitation	3 "

METHOD. The patient was comfortably seated, the arm at his side and the elbow and forearm supported. The systolic and diastolic pressures were taken by the Korotkow method, using a wide cuff. The highest level of armlet pressure at which sound was audible was read as the systolic pressure. The level of armlet pressure at which all sound suddenly declined was taken as the index of diastolic pressure. The arm was then raised to an angle of 45 degrees from the side of the chest and the readings again recorded. This was repeated for 90, 135 and 180 degrees respectively, while the patient's elbow was supported by an assistant.

Table I presents the form in which our data were collected, with a list of characteristic readings from the normal cases.

TABLE I.

	Syst.	Dias.	S.	D.	S.	D.	S.	D.	S.	D.	S.	D.
Blood-pressure, seated	118	80	109	65	112	68	110	68	120	70	100	75
Arm elevated 45 degrees	108	68	112	50	106	65	102	58	105	70	104	75
" " 90 "	104	64	110	54	110	55	96	50	98	55	100	70
" " 135 "	92	60	102	30	76	52	76	40	86	50	80	60
" " 180 "	90	50	82	0	60	45	35	0	68	48	80	48
	Case I.		Case II.		Case III.				Case IV.			

BLOOD-PRESSURE READINGS IN THE NORMAL CASES. The effect of the position of the arm on blood-pressure readings was studied in 27 cases of normal heart; in all 47 series of tests were made. The differences were fairly constant for the individual. Fig. 1 shows graphically and very clearly the average of the entire series of figures from this group. The systolic pressure fell an average of 8 mm. of mercury in the first 45 degrees of elevation, 6 mm. more to 90 degrees, 14 mm. more to 135 degrees and 25 mm. on raising the arm vertically; a total fall of 53 mm. in the systolic pressure in 180 degrees of elevation. The diastolic pressure shows a parallel curve, slightly less than the systolic, with a total fall of 42 mm. On lowering the elbow to the previous position the pressure promptly

returns to its former reading. Table II presents a list of characteristic figures as they were calculated from the normal group of cases.

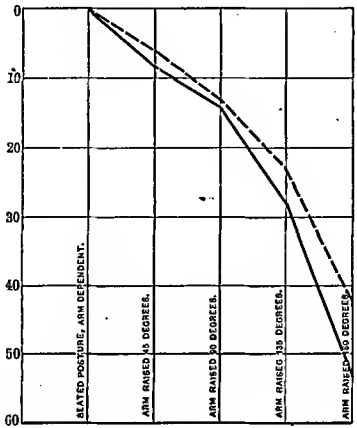

FIG. 1.—Effect of the position of the arm on blood-pressure measurements: Average in twenty-seven cases with normal cardiovascular conditions.

TABLE II.

Elevation of 45 degrees.		From 45 to 90 degrees.		From 90 to 135 degrees.		From 135 to 180 degrees.	
Syst.	Diast.	Syst.	Diast.	Syst.	Diast.	Syst.	Diast.
− 2	−16	+ 2	−20	−26	−40	−14	− 0
−10	− 2	− 2	−12	−14	−20	−14	−40
− 2	− 0	− 6	− 8	−24	− 6	− 9	−15
− 8	− 4	− 2	− 4	− 6	−10	−24	− 0
−10	− 0	−20	−30	− 5	− 5	− 0	− 2
−15	− 0	− 7	−15	−12	− 5	−18	−12
+ 4	− 0	− 4	− 5	−20	−10	− 0	−36
− 1	−10	− 0	− 6	−18	−20	−21	−56
− 8	−14	− 0	−10	−10	− 4	− 8	−10
−10	− 8	−14	−14	− 4	−10	−10	−11
− 6	− 3	− 6	−13	−24	− 7	−10	−40
− 8	−10	− 6	− 8	−20	−10	−30	−12

POSITION OF THE ARM AND BLOOD-PRESSURE READINGS IN NEUROCIRCULATORY ASTHENIA. Thirteen cases of neurocirculatory asthenia were studied in which 21 series of arm tests were made. The curve in this condition is distinctly exaggerated over the normal (Fig. 2). The change of pressure, both systolic and diastolic, is more precipitate, 15 mm. up to 90 degrees elevation and 52 mm. more up to 180 degrees, a total fall of 67 mm. systolic pressure in 180 degrees elevation of the arm and of 50 mm. diastolic pressure.

This is significant and is probably the result of the vasomotor instability in these cases. It is therefore to be observed that it is not alone the hydrostatic pressure that factors in this difference, but the state of the vasomotor support as well. It was in these cases that an occasional rise of pressure occurred upon elevating the arm, synchronous with a sudden increase of pulse-rate. These were not usual and only transient, and depended probably upon the nervous instability so characteristic of this malady. In a few cases the sounds were audible, with the arm in the elevated position without inflating the cuff.

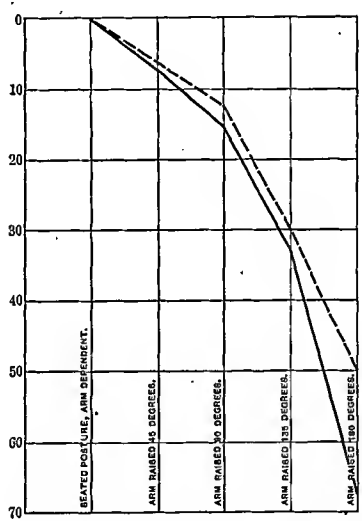

FIG. 2.—Effect of the position of the arm on blood-pressure measurements: Average in thirteen cases of neurocirculatory asthenia.

IN THYROTOXIC CASES AND EXOPHTHALMIC GOITRE. Still more striking changes of blood-pressure readings were obtained in the cases of exophthalmic goitre and thyrotoxic heart. Ten series of tests were made in the 7 cases observed. The diminution of systolic pressure on raising the arm was as follows: 12 mm. in 45 degrees, 9 mm. more to 90 degrees, 13 mm. more to 135 degrees and finally 50 mm. in the last angle. That is, a total of 84 mm. of mercury systolic pressure was lost by elevating the arm to 180 degrees (Fig. 3). In these cases the systolic sound was often audible at 0 pressure, with the arm in the elevated position.

In the groups thus far observed the amount of fall of pressure progressively increased with the elevation of the arm.

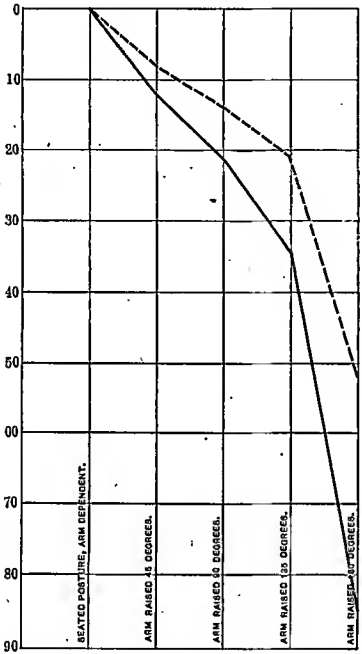

FIG. 3.—Effect of the position of the arm on blood-pressure measurements: Average in seven cases of hyperthyroidism and exophthalmic goitre.

IN CASES OF NEPHRITIC HYPERTENSION. In 5 cases of nephritic hypertension the characteristic feature was the blood-pressure maintained high despite elevation of the arm. In the previous groups we note that the fall of pressures increases as the arm is raised. In the group of hypertension cases, on the contrary, whatever fall takes place occurs at first; thus 9 mm. up to 45 degrees elevation, 6 mm. more up to 90 degrees, 6 more to 135 degrees and only 2 mm. finally; a total fall of only 23 mm. of mercury (Fig. 4).

That arterial hypertonus is an important factor in the high blood-pressure readings obtained in nephritis was repeatedly emphasized by Russell. Janeway and Park also found that the contraction of the arterial muscle is a definite factor in influencing its compressi-

bility, and therefore a positive factor in blood-pressure readings. Our findings in the cases of hypertension indicate that the hyper-

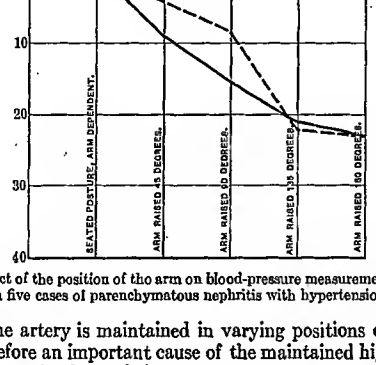

FIG. 4.—Effect of the position of the arm on blood-pressure measurements: Average in five cases of parenchymatous nephritis with hypertension.

tonus of the artery is maintained in varying positions of the arm, and is therefore an important cause of the maintained high pressure when the arm is elevated.

FIG. 5.—Effect of the position of the arm on blood-pressure measurements: Average in three cases of aortic regurgitation.

SIMPLE AND PAROXYSMAL TACHYCARDIA. In the 5 cases of simple tachycardia and the 5 cases of paroxysmal tachycardia a total of

fifteen tests were made. The difference of behavior of these cases from the normal is not marked. Elevation of the arm caused less of a fall of pressure in these cases than in the normal. We may assume this as natural, these cases showing slightly lower blood-pressure than normal.

In Endocarditis. The same holds for two cases of compensated mitral regurgitation, in which four tests were made. The curve approximates the normal.

But aortic regurgitation seems to give a characteristic fall of pressure on elevating the arm. The diastolic pressure falls more than the systolic and more promptly than normally, accomplishing its main reduction up 90 degrees of elevation (Fig. 5). It is in this condition that there exists a marked difference between the arm and leg readings.

Conclusions. 1. Tests were made to note the effect of raising the arm upon auscultatory blood-pressure readings. Groups of cases were studied, including the normal, neurocirculatory asthenia, thyrotoxic conditions, tachycardia, nephritic hypertension and endocarditis.

2. The normal effect is a progressive fall of the systolic and diastolic pressure readings as the arm is raised upward; the amount of fall increases with the elevation.

3. The fall of pressures is more marked than normal in cases of neurocirculatory asthenia and is most precipitate in cases of hyperthyroidism and exophthalmic goitre.

4. The pressure yielding very little to elevation of the arm is a characteristic feature in nephritic hypertension.

5. In aortic regurgitation the diastolic pressure falls more steeply than the systolic, and its main reduction occurs up to 90 degrees elevation.

6. The graphic curves suggest a diagnostic import to the findings.

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